Abstract Submitted to the
International Conference on Strongly Correlated Electron Systems
University of Michigan, Ann Arbor
August 6-10, 2001

Magnetic behaviour of $Yb_3Cu_4Ge_{4-x}Sn_x$ and $Gd_3Cu_4Ge_4$

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We have studied the magnetic properties of iso-structural $Yb_3Cu_4Ge_4$ and $Gd_3Cu_4Ge_4$ and the effect of replacing Ge by Sn in the Yb compound. The two compounds have the orthorhombic, $Zr_3Cu_4Si_4$-type structure and there are two symmetry in-equivalent rare earth sites in the unit cell in the ratio of 2:1. From ^{170}Yb Mössbauer spectroscopy, heat capacity, magnetisation and resistivity data we find that $Yb_3Cu_4Ge_4$ and $Gd_3Cu_4Ge_4$ order magnetically at 7.3K and 8.6K, respectively. Mössbauer data show that the Yb ions sitting at two crystallographic sites are submitted to quite different crystal fields, arising from different local symmetries. The thermal variation of the magnetic hyperfine field, tracked by Mssbauer measurements, follows a mean field law for S=1/2 with $T_m \sim$ 8K. We do not see any signature of the Kondo-type behaviour in the resistivity of the Yb compound. Preliminary investigations show that $Yb_3Cu_4Ge_3Sn$ has the same structure as $Yb_3Cu_4Ge_4$ but the lattice has considerably expanded $\sim$5%. However, the lattice expansion has practically no effect on T_m as inferred from the heat capacity measurements.